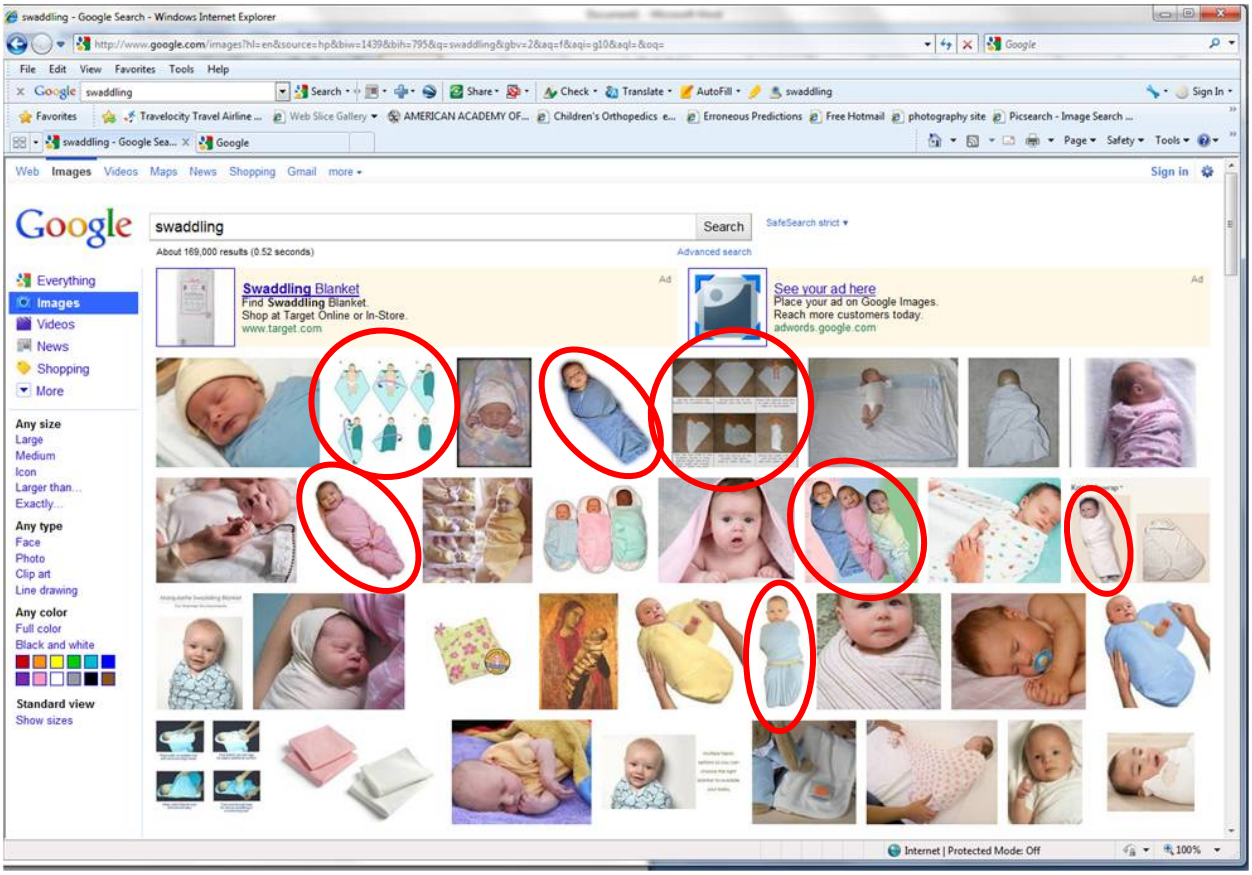
The purpose of this communication is to raise awareness of a potential health concern for babies who are swaddled tightly. This practice may harm infant hips.

Here is a screen shot of the first page of Google images of swaddling methods with methods circled in red that may be harmful to infant hips because the legs are held straight in full extension and together (adducted).



Swaddling in North America has become increasingly popular during the past decade. According to a 2010 survey of over 500 parents of a child born from 2008-2010, 82% report that they swaddle their infants for sleep. The survey, focusing on parents' concerns about SIDS, was conducted by Ipsos Public Affairs: [http://www.ipsos-na.com/news-polls/pressrelease.aspx?id=4941].

There are some benefits of swaddling as noted in this abstract of an article published in Pediatrics 120:e1097, 2007 [1]

Swaddling: A Systematic Review

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ABSTRACT

Swaddling was an almost universal child-care practice before the 18th century. It is still tradition in certain parts of the Middle East and is gaining popularity in the United Kingdom, the United States, and the Netherlands to curb excessive crying. We have systematically reviewed all articles on swaddling to evaluate its possible benefits and disadvantages. In general, swaddled infants arouse less and sleep longer. Preterm infants have shown improved neuromuscular development, less physiologic distress, better motor organization, and more self-regulatory ability when they are swaddled. When compared with massage, excessively crying infants cried less when swaddled, and swaddling can soothe pain in infants. It is supportive in cases of neonatal abstinence syndrome and infants with neonatal cerebral lesions. It can be helpful in regulating temperature but can also cause hyperthermia when misapplied. Another possible adverse effect is an increased risk of the development of hip dysplasia, which is related to swaddling with the legs in extension and adduction. Although swaddling promotes the favorable supine position, the combination of swaddling with prone position increases the risk of sudden infant death syndrome, which makes it necessary to warn parents to stop swaddling if infants attempt to turn. There is some evidence that there is a higher risk of respiratory infections related to the tightness of swaddling. Furthermore, swaddling does not influence rickets onset or bone properties. Swaddling immediately after birth can cause delayed postnatal weight gain under certain conditions, but does not seem to influence breastfeeding parameters.

This article calls attention to the risk of developmental hip dysplasia but this message may not be widely appreciated by parents, nurses, and pediatricians.

There is ample evidence that tight swaddling with the legs in full extension is major risk factor for hip dislocation and hip dysplasia. Kutlu, et.al. identified this association in Turkey almost twenty years ago, and the practice of tight swaddling was changed through public health efforts.[2]

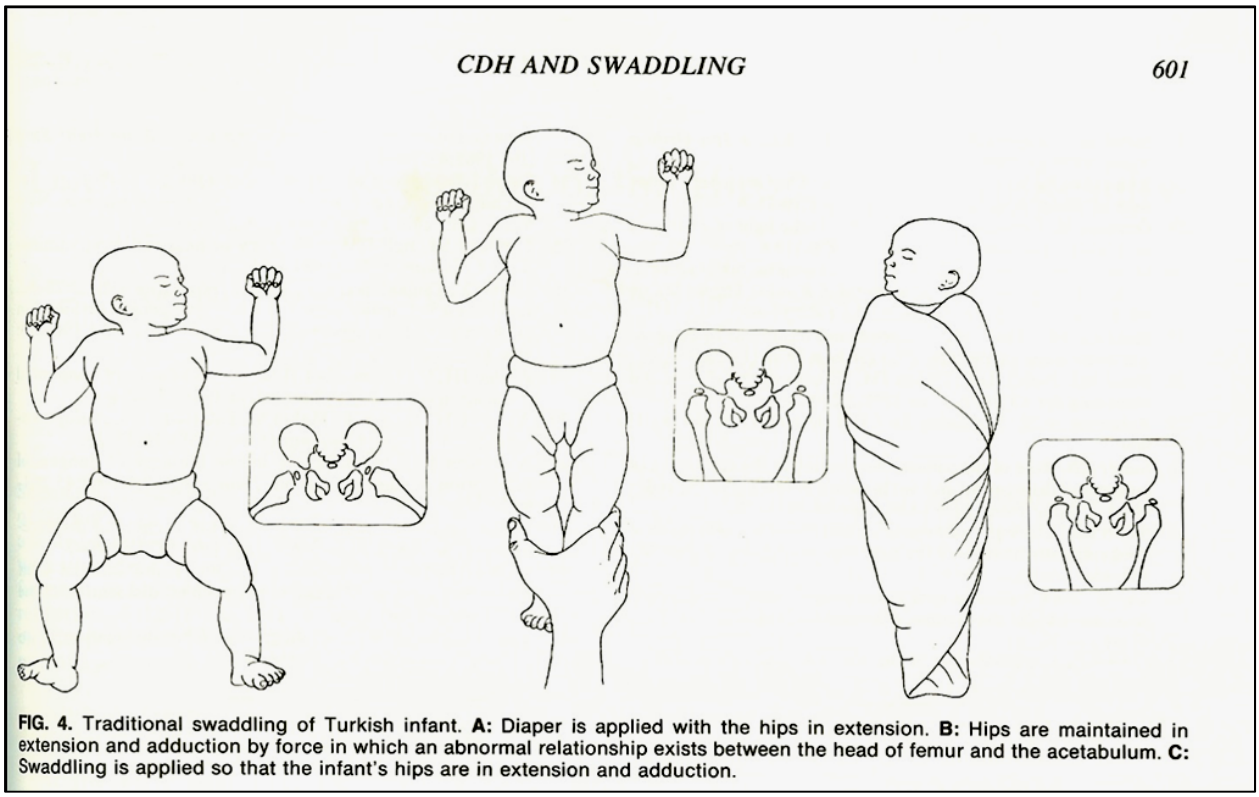

FIG. 4. Traditional swaddling of Turkish infant. **A:** Diaper is applied with the hips in extension. **B:** Hips are maintained in extension and adduction by force in which an abnormal relationship exists between the head of femur and the acetabulum. **C:** Swaddling is applied so that the infant's hips are in extension and adduction.

Kutlu, et.al. JPO 12:598-602, 1992

Although public health efforts were initiated in Turkey following that report, the association between swaddling and hip dislocation has not been completely eliminated. A prospective study of neonatal diagnosis in Turkey was published in 2007.[3] The authors reviewed 3,541 infants who had neonatal examination followed by routine Ultrasound screening at 4-6 weeks of age. Hip dysplasia was identified at the time of ultrasound study in 21% of the 151 infants that had been swaddled. This was a greater risk factor than any other factor including breech delivery, gender, or family history.

Table 3 Risk factors in infants with DDH (Graf type IIb or more severe)

Risk factors	Number of infants	Infants with DDH	Percent	P value
Swaddling use	151	32	21.19	0.000
Positive family history	331	22	6.64	0.000
Female gender	1,803	112	6.21	0.000
Breech delivery	212	19	8.96	0.000
First born child	2,127	89	4.18	0.978
Caesarean section	2,092	71	3.39	0.846
Associated skeletal anomaly	19	1	5.26	0.812
Oligohydramnios	14	0	0	1.000
Low birth weight	253	6	2.37	0.131
Prematurity	262	7	2.67	0.198

H. Dogruel, et.al. Intl. Orthop. (2008) 32:415–419

Similar findings were noted in Japan more than thirty years ago.[4] A national campaign to eliminate swaddling with the legs in extension reduced the incidence of DDH to 0.2% from an incidence of 1.1%-3.5% prior to the national campaign.

Recent Advances in the Prevention, Early Diagnosis, and Treatment of Congenital Dislocation of the Hip in Japan

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Results of animal experiments and then of clinical study of newborn infants suggested that the main mechanical factor causing hip dislocation is prolonged tension on the hamstrings and iliopsoas and that each of these muscles has a synergistic effect in the production of hip dislocation during the perinatal period. It was, therefore, presumed that the high incidence of congenital dislocation of the hip (CDH) in Japan might be due mainly to the Japanese tradition of forcibly maintaining the legs of infants in an extended position with a "swathing diaper." The incidence of CDH in Japanese infants prior to 1965 was as high as 1.1%–3.5%. In an attempt to reduce the incidence of CDH, examination of newborns was performed on a national scale. However, early screening methods for hip abnormalities were not adequately reliable in Japan to allow identification of conditions that would later become CDH. In 1975 a national campaign to avoid prolonged extension of the hips and knees of infants during the early postnatal period was initiated. As a result, there has been a remarkable reduction in the incidence of CDH in infants, to less than 0.2%.

normalities decreased to less than 0.4% and that of CDH during infancy to approximately 0.2%. The present paper describes the research and sociomedical activities performed in Japan during this ten-year period that resulted in such a marked reduction in the number of late diagnoses of CDH in the latter half of the 1970s; in addition, the treatment scheme for CDH most widely accepted in Japan is presented.

EARLY DIAGNOSIS AND ITS PITFALLS

Many attempts to diagnose CDH early in newborn infants were made after 1925, when Hayashi[2] first indicated the importance of early diagnosis. However, its popularization on a national scale did not occur until 1963, when Yamamuro and Doi,[11] in cooperation with von Rosen[9] introduced the Swedish

Clin. Orthop. Rel. Res. 184:34-40, 1984

Even prior to these reports, Robert B. Salter had called attention to the association between swaddling and developmental dislocation of the hips.[5]

Fig. 3.—(a) A reproduction of one of the figures of Andrea Della Robia (fourteenth century). The infant is swaddled in bandages ("fascia tura"). The original figure is in the Infant's Hospital, Florence, Italy. (b) A contemporary Italian baby living in Toronto, Ontario. The baby is swaddled in a blanket with the hips in extension and adduction. A somewhat similar type of swaddling ("Steckkissen") is used in West Germany. (c) A northern Canadian Indian baby strapped to a cradleboard ("tikonagan") with the hips in extension and adduction. A somewhat similar type of cradleboard ("komse") is used by Laplanders in Northern Scandinavia.

not seen in relation to other congenital abnormalities of the musculoskeletal system. This wide variation is undoubtedly due to a combination of genetic factors and environmental influences. A study of the geographical and racial incidence suggests that one of the environmental influences that may be significant in the etiology of the initial dislocation is the position in which the hips of newborn infants are maintained during the early months of postnatal growth and development. Among those races in which the hips of newborn infants are commonly held in flexion and abduction, the incidence of congenital dislocation of the hip is remarkably low. Low-

These observations suggest that a congenitally unstable and dislocatable hip, which has been maintained in the position of flexion and abduction during intrauterine life, is "protected" by the postnatal position of flexion and abduction and made worse by the postnatal position of extension and adduction. It would seem that the newborn hip joint of the human is not developmentally prepared for a sudden, complete and maintained change from the intrauterine position of flexion to the erect position of extension in the early months of postnatal life, particularly if the hip joint is already congenitally unstable from some cause such as capsular laxity.

RB Salter, Gibson Memorial Lecture: "Etiology, Pathogenesis and Possible Prevention of Congenital Dislocation of the Hip." Canadian Medical Assoc. J. 98:933-45, 1968.

The International Hip Dysplasia Institute, a not-for-profit entity, has released the following Position Statement

Swaddling: IHDI Position Statement

Summary Statement: Swaddling infants with the hips and knees in an extended position increases the risk of hip dysplasia and dislocation. It is the recommendation of the International Hip Dysplasia Institute that infant hips should be positioned in slight flexion and abduction during swaddling. The knees should also be maintained in slight flexion. Additional free movement in the direction of hip flexion and abduction may have some benefit. Avoidance of forced or sustained passive hip extension and adduction in the first few months of life is essential for proper hip development.

The full opinion, complimentary brochures and a video about proper swaddling can be found at www.hipdysplasia.org and specifically at the following page of that website: http://www.hipdysplasia.org/For-Parents/Living-with-Hip-Dysplasia/Hip-Healthy/default.aspx

1. van Sleuwen, B.E., et.al., Swaddling: A Systematic Review, Pediatrics 120:e1097-e1106, 2007
2. Kutlu, A., et.al. Congenital dislocation of the hip and its relation to swaddling used in Turkey, JPO 12:598-602, 1992
3. Dogruel, H., et.al. Clinical examination versus ultrasonography in detecting developmental dysplasia of the hip. Intl. Orthop. 32:415-19, 2008
4. Yamamuro, T. and Ishida K, Recent advances in the prevention, early diagnosis, and treatment of congenital dislocation of the hip in Japan, Clin. Orthop. Rel. Res. 184:34-40, 1984
5. RB Salter, Gibson Memorial Lecture: “Etiology, Pathogenesis and Possible Prevention of Congenital Dislocation of the Hip.” Canadian Medical Assoc. J. 98:933-45, 1968.

Summary

Tight swaddling with the legs adducted and in extension is widely recognized by pediatric orthopedic surgeons as a risk factor for hip dislocation and hip dysplasia. Twenty of more years ago the lessons of correct swaddling were learned and implemented in countries that practiced incorrect swaddling methods. However, swaddling has recently gained popularity among parents in North America, most likely without knowledge of the risk of DDH. The benefits and risks of swaddling have recently been studied by pediatricians, and these benefits and risks are becoming more widely understood. However, there appears to be a need for greater awareness regarding the risk of hip dysplasia from incorrect swaddling so the lessons of the past will not be forgotten.